



### DECLARATION

I, the undersigned, Tomoko MOKUDAI, residing at 2-45-1-402 Toyoda, Hino-shi, Tokyo, JAPAN, do solemnly and sincerely declare that I well understand the Japanese Language and the English language and that the attached English translation of a certified copy of Japanese Patent Application No. 2000-135226 is true, correct and faithful translation to the best of my knowledge and belief from the Japanese language into the English language.

Dated this 28th day of April, 2004

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Liquid Processing Apparatus and

Liquid Processing Method

[Claims]

[Claim 1]

A liquid processing apparatus comprising:  
processing target holding means for holding a processing target and capable of rotating the processing target;  
first processing liquid supply means capable of supplying a first processing liquid to an edge of one surface of the processing target, while said processing target holding means holds and rotates the processing target;  
second processing liquid supply means capable of supplying a second processing liquid to the edge of the surface of the processing target to which the first processing liquid has been supplied by said first processing liquid supply means; and  
waste liquid sucking means arranged closely to the edge of the processing target and capable of sucking waste liquids of the first processing liquid and second processing liquid.

[Claim 2]

The liquid processing apparatus according to claim 1, wherein a position at which said second processing liquid supply means supplies the second processing liquid to the edge of the processing target is more downstream with respect to a rotary direction of the processing target than a position at which said first processing liquid supply means supplies the first processing liquid.

[Claim 3]

The liquid processing apparatus according to claim 1, wherein a position at which said second processing liquid supply means supplies the second processing liquid to the edge of the processing target is more outward with respect to a direction toward a center of the processing target than a position

at which said first processing liquid supply means supplies the first processing liquid.

[Claim 4]

The liquid processing apparatus according to claims 1 to 3, wherein said first processing liquid supply means and said second processing liquid supply means are arranged at an angle of 0 to 90° to a plane of the processing target.

[Claim 5]

The liquid processing apparatus according to claims 1 to 4, wherein said first processing liquid supply means and said second processing liquid supply means are arranged closely to one surface and the other surface of the plane of the processing target.

[Claim 6]

The liquid processing apparatus according to claims 1 to 5, wherein said first processing liquid supply means, said second processing liquid supply means, and said waste liquid sucking means are arranged around the processing target in a plural number.

[Claim 7]

The liquid processing apparatus according to claims 1 to 6, wherein said first processing liquid supply means, said second processing liquid supply means, and said waste liquid sucking means are formed integrally, and are so arranged as to be able to advance and retreat to and from a vicinity of the processing target at a time the processing liquid is liquid-processed.

[Claim 8] A liquid processing method comprising:

a step of supplying a first processing liquid to an edge of one surface of a processing target while the processing target is rotated;

a step of supplying a second processing liquid to a downstream side of where the first processing liquid is supplied; and

a step of evacuating a vicinity of the processing target to which the first and second processing liquids are supplied.

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

The present invention relates to a liquid processing apparatus, and particularly relates to an apparatus for washing the edge of a substrate.

[0002]

[Prior Art]

A manufacturing process of an electronic device such as a semiconductor, etc. includes a process for forming a thin film on a substrate such as a wafer or the like. For example, manufacture of a semiconductor wafer having a metal wiring includes a process for forming a metal thin film by plating, after forming a seed layer by PVD or the like.

[0003]

Further, in the manufacturing process of a semiconductor device, if a thin film at the edge remains present without being removed, the thin film, at the time of transfer, might be peeled and scattered by contact to the carrier, producing particles which may pollute the carrier and the device.

[0004]

Particularly, in the process for manufacturing a Cu wiring of a semiconductor wafer, the above problem is critical because Cu has a great influence upon Si and SiO<sub>2</sub>. As shown in FIG. 7, a Cu seed film 72 and a Cu plated film 71 are present at an edge 73 of a wafer immediately after being plated, and the carrier or the like might be polluted by Cu if these unnecessary films are peeled.

[0005]

The above-described pollution of the device due to the thin films peeled from the edge leads to a reduction in the yield of the device, in a trend toward a higher density of devices. Therefore, it is necessary to remove the thin films at the edge by washing (etching) the edge of the substrate.

## [0006]

As a washing method for a substrate edge for the above purpose, there is known a method of splashing a resist solvent to the edge of a substrate onto which a resist film is applied, thereby to remove the unnecessary film at the edge of the substrate. This method is for carrying out a washing process by splashing a resist solvent to the edge from a nozzle or the like from above the surface of the substrate.

## [0007]

## [Problem to be Solved by the Invention]

However, the above-described method is a method relating to removal of a resist film by a solvent, and can not simply be applied to washing of the edge of a plated substrate on which is formed a metal thin film which requires a chemical reaction to be removed. Further, in a case where this method is used for washing the edge of a plated substrate, there is a problem that the splashed washing liquid and the dissolved material of the thin film scatter onto the surface of the substrate and give an adverse influence onto a device manufacture area.

## [0008]

Accordingly, an object of the present invention is to provide a liquid processing apparatus which can process the edge of a substrate without causing an adverse influence to a device.

Another object of the present invention is to provide a liquid processing apparatus for a semiconductor substrate, which can be applied to a plating apparatus and which can process the edge of a semiconductor substrate without causing an adverse influence to a device.

## [0009]

## [Means for Solving the Problem]

A liquid processing apparatus according to the present invention is characterized by comprising:

processing target holding means for holding a processing target and capable of rotating the processing target;

first processing liquid supply means capable of supplying a first processing liquid to an edge of one surface of the processing target, while the processing target holding means holds and rotates the processing target;

second processing liquid supply means capable of supplying a second processing liquid to the edge of the surface of the processing target to which the first processing liquid has been supplied by the first processing liquid supply means; and

waste liquid sucking means arranged closely to the edge of the processing target and capable of sucking waste liquids of the first processing liquid and second processing liquid.

[0010]

According to the above-described structure, it is possible to discharge different chemicals separately to a rotating processing target and to process the edge of the processing target by mixing the chemicals on the surface of the processing target. Further, since the chemicals are discharged to only the edge of the processing target, the central region of the processing target can be prevented from being adversely influenced. Furthermore, since the waste liquid after processing the edge of the processing target is sucked from a sucking hole provided closely to the edge of the processing target to be disposed of, the processing liquid is kept from scattering to the central region of the processing target.

[0011]

In the above-described liquid processing apparatus, it is preferred that a position at which the second processing liquid supply means supplies the second processing liquid to the edge of the processing target be more downstream with respect to a rotary direction of the processing target than a position at which the first processing liquid supply means supplies the first

processing liquid.

[0012]

According to the above-described structure, by discharging the first processing liquid to the edge of the processing target onto the surface of the rotating processing target and by discharging the second processing liquid from a downstream with respect to the rotary direction of the processing target in the state where the first processing liquid is spread over the edge of the processing target, it is possible to process the edge of the processing target by sufficiently mixing the two processing liquid on the edge of the processing target.

[0013]

In the above-described liquid processing apparatus, it is preferred that a position at which the second processing liquid supply means supplies the second processing liquid to the edge of the processing target be more outward with respect to a direction toward a center of the processing target than a position at which the first processing liquid supply means supplies the first processing liquid.

[0014]

According to the above-described structure, the second processing liquid can be effectively discharged toward and mixed with the first processing liquid which is discharged onto the surface of the rotating processing target and flows outwardly with respect to the direction toward the center of the processing target due to centrifugal force.

[0015]

In the above-described liquid processing apparatus, it is preferred that the first processing liquid supply means and the second processing liquid supply means be arranged at an angle of 0 to 90° to a plane of the processing target.

[0016]

According to the above-described structure, it is possible to restrict scattering of the processing liquids discharged to the surface of the processing

target and waste liquids after processing, to the central region of the processing target.

[0017]

In the above-described liquid processing apparatus, it is preferred that the first processing liquid supply means and the second processing liquid supply means be arranged closely to one surface and the other surface of the plane of the processing target.

[0018]

In the above-described liquid processing apparatus, the first processing liquid supply means, the second processing liquid supply means, and the waste liquid sucking means may be arranged around the processing target in a plural number.

[0019]

In the above-described liquid processing apparatus, it is preferred that the first processing liquid supply means, the second processing liquid supply means, and the waste liquid sucking means be formed integrally, and be so arranged as to be able to advance and retreat to and from a vicinity of the processing target at a time the processing liquid is liquid-processed.

[0020]

A liquid processing method according to the present invention is characterized by comprising:

a step of supplying a first processing liquid to an edge of one surface of a processing target while the processing target is rotated;

a step of supplying a second processing liquid to a downstream side of where the first processing liquid is supplied; and

a step of evacuating a vicinity of the processing target to which the first and second processing liquids are supplied.

[0021]

According to the above-described method, it is possible to process the edge

of the processing target by discharging different processing liquids separately to the rotating processing target and mixing them on the surface of the processing target. Further, since the processing liquids are discharged to only the edge of the processing target, it is possible to prevent the central region of the processing target from being adversely influenced. Furthermore, since the waste liquid after processing the edge of the processing target is sucked from a sucking hole provided closely to the edge of the processing target to be disposed of, the processing liquid is prevented from scattering to the central region of the processing target.

[0022]

[Embodiments of the Invention]

A plating apparatus including a washing apparatus for a semiconductor substrate according to an embodiment of the present invention will now be explained with reference to the drawings.

[0023]

FIG. 1 to FIG. 3 are diagrams showing the entire structure of a plating apparatus 11 including a washing apparatus for a semiconductor substrate according to the embodiment of the present invention, where FIG. 1 is a three-dimensional cubic diagram, FIG. 2 is a plan view, and FIG. 3 is a side view.

As illustrated, this plating apparatus 11 comprises a cassette station 21 and a processing station 22.

[0024]

The cassette station 21 transfers wafers, which are supplied to the apparatus 11 in the unit of wafer cassette from the outside, from a cassette 23a into the plating apparatus 11, or transfers wafers after being plated, from the plating apparatus 11 out to a cassette 23b.

[0025]

The cassette station 21 is provided with a cassette mounting 24, onto which

the wafer cassette 23a storing wafers to be plated is supplied from the outside. Further, on the mounting 24, plated wafers are stored into the cassette 23b for out-transfer.

[0026]

Transfer of wafers on the above-described mounting 24 is conducted by a first transfer mechanism 25. The first transfer mechanism 25 can be moved in an x-axial direction and can be lifted up and down in a z-axial direction so that it can access a plurality of wafer cassettes 23 mounted on the mounting 24. Further, the first transfer mechanism 25 is rotatable around the z axis so that it can transfer wafers from the processing station 22 to the mounting 24.

[0027]

The cassette station 21 and the processing station 22 have the interior atmosphere maintained clean by a down flow of clean air.

[0028]

The processing station 22 has, at predetermined locations, a plurality of plating units 26 for performing plating on a wafer one by one and a plurality of washing/drying units 27 for performing washing and drying after the plating.

[0029]

In the plating units 26, plating is applied to wafers on which a seed layer is formed to form, for example, a Cu thin film on the wafers. In the washing/drying units 27, the front surface, the back surface, and the edge of a plated wafer are washed (etched) with a washing liquid such as a chemical, pure water, etc. and after the washing, the wafer is rotated at high speed under N<sub>2</sub> purge to dry the wafer, as will be described later.

[0030]

As shown in FIG. 2, the processing station 22 is provided with a second transfer mechanism 29 at the center, around which respective processing units are arranged radiately. Further, as shown in FIG. 1 and FIG. 3, the processing station is structured by an upper and a lower two stages. The

upper stage and lower stage of the processing station 22 are respectively constituted by four processing units which are arranged radiately around the second transfer mechanism 29, and the processing station 22 thus has eight units.

[0031]

The embodiment shown in FIG. 1 and FIG. 3 illustrates an apparatus structure wherein four plating units 26 are arranged on the lower stage and two washing/drying units 27 and two extra units 28 are arranged on the upper stage.

[0032]

Transfer of wafers inside the processing station 22 is conducted by the second transfer mechanism 29. The second transfer mechanism 29 receives wafers which are transferred by the first transfer unit 25 from the cassette station 21 and then mounted on a mounting 30 in the processing station 22, and transfers them to any of the plating units 26 on the lower stage. After the plating is completed, the second transfer mechanism 29 further transfers the wafers to the washing/drying units 27. Lastly, the second transfer mechanism 29 transfers the wafers which have been through the plating units 26 and washing/drying units 27 to the mounting 30, from which the first transfer mechanism 25 receives the wafers and stores them in a cassette 23. The first transfer mechanism may receive wafers from the washing/drying units directly, not via the mounting 30.

[0033]

The second transfer mechanism 29 can be rotated around the z axis and can be lifted upward and downward in the z-axial direction, so that it can access each processing unit in the processing station 22 having the two-stage structure.

[0034]

The second transfer mechanism 29 has three arms, one of which is

dedicated to transfer of wafers from the mounting 30 to the plating units 26, another one of which is dedicated to transfer of wafers from the plating units 26 to the washing/drying units 27, and still another one of which is dedicated to transfer from the washing/drying units 27 to the mounting 30 in order to minimize pollution by particles, chemicals, etc.

[0035]

In the above-described embodiment, the apparatus structure is such that four plating units 26 are arranged on the lower stage, and two washing/drying units 27 and two extra units 28 are arranged on the upper stage. However, an apparatus structure wherein the extra units 28 are applied to other purposes is available. For example, a structure is available wherein four plating units 26 are arranged on the lower stage, and one plating unit 26 and three washing/drying units 27 are arranged on the upper stage.

[0036]

Further, the extra unit 28 may be such a processing unit as can be combined with the plating unit 26 and the washing/drying unit 27, for example an annealing unit for performing annealing after plating.

[0037]

A washing apparatus constituting the washing/drying unit 27 will be explained below. FIG. 4 shows the structure of a washing apparatus according to the present embodiment.

The washing apparatus of the present embodiment is structured such that a generally cylindrical cup 402 whose top surface is opened is provided in a square housing 401 in both sides of which inlet/outlet ports 417 for the second transfer mechanism 29 and having gate valves 416 are formed.

[0038]

At the central position of the housing 401, a shaft 407 is provided. The shaft 407 is rotated at a given number of revolutions by the drive of a hollow motor (not illustrated) provided outside the housing 401. A rotation table 406

is secured to the shaft 407. The operation of the hollow motor is controlled by a control unit 418.

[0039]

The control unit 418 is constituted by an arithmetic processing unit and a ROM or the like storing a processing program, etc., and controls the operation of the entire washing apparatus. Explanation of the functions of the control unit 418 will be omitted, in order to facilitate understanding of the entire apparatus.

[0040]

A lifter 408 is formed in the interior of the shaft 407. A lift plate 409 is secured to the top of the lifter 408, and is present between a wafer W and the rotation table 406 in a case where the wafer W is held by a plurality of holding members 404 arranged on the rotation table.

[0041]

The lifter 407 is so structured as to be able to be lifted up and down by a motor (not illustrated), and is lifted upward at the time of washing of the edge of the wafer W by a later-described edge remover 421 and is present at a lowered position at the time of other processes. The lifter 408 is rotated at a given number of revolutions by the drive of a motor (not illustrated) provided outside the housing 401.

[0042]

The interior of the lift plate 409 is hollow, and communicates with a pipe 410 which passes through the interior of the lifter 408. The pipe 410 is connected to a pump (not illustrated) provided outside the housing 401, such that it can be evacuated. When the wafer W is mounted on the lift plate 409, the wafer W is vacuum-chucked to the lift plate 409 by evacuation of this pump.

[0043]

Further, the pipe 410 is connected to a tank storing pure water or N<sub>2</sub> gas,

so that pure water or N<sub>2</sub> gas flows therethrough. Pure water or N gas passing through the pipe 410 is supplied upward from a plurality of holes opened in the lift plate 409.

[0044]

Further, a gas channel 411 is formed in the space between the shaft 407 and the lifter 408, and an inert gas, for example, nitrogen gas is flowed out from the gas channel 411. The flowed-out inert gas flows to the edge of the rotation table 406 along the surface of the rotation table 406. Accordingly, the rotation table 406 also serves as a gas diffusion plate.

[0045]

Since the inert gas is flowed out from the center of the lower surface of the rotation table 406 outwardly and from the edge of the rotation table 406, i.e., from the edge of the wafer W outwardly during a rotation process, that is, during a time in which the wafer W is subjected to a washing process, it is possible to prevent particles or the like from invading to the back surface of the wafer W. Therefore, the back surface of the wafer W can be prevented from pollution.

An exhaust outlet 412 is provided in the space between the cup 402 and the lifter 407, and exhaust gas and exhaust gas including waste liquid of washing liquid or the like flow in the exhaust outlet 412.

[0046]

A plurality of holding members 404 are arranged on the rotation table 406, and the wafer W is held by the holding members 404. As shown in FIGS. 5, the holding member 404 has a structure wherein a holding portion 54 at the upper side and a biasing portion 55 at the lower side are integrated. The holding portion 54 has a step formed at its upper end, whereby the wafer W is held. The holding portion 54 is jointed to the supporting member 53 by a turning fulcrum 56 which is set at an upper end portion of the supporting member 53. The holding member 404 can turn around the turning fulcrum 56.

The weight of the biasing portion 55 is set larger than that of the holding portion 54, thereby the biasing portion 55 serves as a plumb bob of the holding member 52.

[0047]

Since the wafer W is rotated at high speed by the shaft 407, the wafer W needs to be held stably. Because of this, the holding member 404 is so structured as not only to hold the wafer W by the step of the holding portion 54 but to hold the edge portion of the wafer W by the biasing of the biasing portion 55.

[0048]

That is, the wafer W, when it is not rotated, is mounted on the holding member 404 and held by the holding portion 54 of the holding member 404. Then, when the rotation table 406 is rotated, the biasing portion 55 tries to move farther outward due to centrifugal force that is exerted on the biasing portion 55, thereby the side of the holding portion 54 of the holding member 404 is pushed toward the center of the rotation table 406, which makes the wafer W be held more firmly.

[0049]

A main washing nozzle (not illustrated) and two edge removers 421 are provided above the rotation table 406. As will be described later, from the main washing nozzle, pure water or N<sub>2</sub> gas is supplied onto the surface of the wafer W, at the time of washing of a lower surface and at the time of washing by pure water.

[0050]

As shown in FIG. 6, the edge removers 421 are provided at two locations on both sides of the wafer W near the edge of the wafer W.

As shown in FIG. 7, the edge remover 421 has a U shape where there is an open space at the central portion, such that the U shape sandwiches a portion of the edge of the wafer W. Further, the edge remover 421 is structured such

that two nozzles, that is, a first nozzle 71 and a second nozzle 72 are buried in one of the sides parallel to the plane of the wafer W. Further, a sucking hole 73 is provided in the central portion of the U shape of the edge remover 421, and this sucking hole 73 is connected to a pump to be evacuated, and is connected to a waste liquid tank (not illustrated).

[0051]

The first nozzle 71 is connected to a tank 419 storing hydrogen peroxide solution ( $H_2O_2$ ), and discharges hydrogen peroxide solution from its nozzle end. The second nozzle 72 is connected to a tank 420 storing an acid-base chemical including inorganic acid such as hydrofluoric acid, hydrochloric acid, sulfuric acid, etc. or organic acid. There will be explained a case where hydrofluoric acid solution is discharged from the nozzle end of the second nozzle 72.

[0052]

As shown in FIG. 7, on the surface of the edge of the wafer W, a Cu seed layer L1 and a Cu layer L2 which is formed thereon by plating are present. The edge remover 421 washes (etches) the edge of the wafer W by splashing hydrogen peroxide solution from the first nozzle 71 and hydrofluoric acid solution from the second nozzle.

[0053]

At this time, dissolved products of the thin films on the edge of the wafer W which are etched by the chemical, unreacted chemical, etc. are sucked to the sucking hole 73 and sent to the waste liquid tank. Accordingly, it is possible to prevent the waste processing liquid from scattering onto a device manufacture area of the wafer W.

[0054]

As shown in FIG. 8, these two nozzles are structured such that the first nozzle 71 for discharging hydrogen peroxide solution is present upper-stream than the second nozzle 72 for discharging hydrofluoric acid solution, with

respect to the rotary direction of the wafer W.

[0055]

Washing (etching) of the edge of the wafer W is advanced by a chemical reaction of a mixture liquid of hydrogen peroxide solution and hydrofluoric acid with Cu. Thus, by first discharging inerter hydrogen peroxide solution to Cu from the first nozzle from the upstream with respect to the rotary direction of the wafer W and by discharging hydrofluoric acid solution in the state where hydrogen peroxide solution is present at the edge of the wafer W, it is possible to etch the edge of the wafer W by a desired washing width, for example, around 2 mm, while preventing the Cu layer from being over-etched.

[0056]

Further, the first nozzle is provided closer than the second nozzle to the center of rotation of the wafer W. This is for ensuring that the hydrofluoric acid solution is discharged onto the flow of hydrogen peroxide solution without fail, in consideration of the fact that the hydrogen peroxide solution discharged first flows to the side counter to the center of the wafer W due to centrifugal force caused by rotation of the wafer W.

[0057]

A discharge angle  $\theta$  of the first nozzle and second nozzle with respect to the wafer W may be set to 0 to 90°, in order to obtain a desired washing width. However, it is preferred that the angle be an acute angle to prevent waste processing liquid from scattering to a device manufacture solution.

[0058]

The main part of the rotary washing apparatus according to the present embodiment is structured as described above, and the washing sequence of the washing apparatus will now be explained below.

[0059]

The second transfer mechanism 29 holding the wafer W which has been plated goes into the washing/drying unit 27 from the inlet/outlet port 417 of the

housing 401, and advances the wafer W to the position right above the lift plate 409 of the lifter 408. When, in this state, the lifter 408 is moved to lift the lift plate 409, the lift plate 409 receives the wafer W from the second transfer mechanism 29. The wafer W mounted on the lift plate 409 with its plated surface facing upward is vacuum-chucked, and thereafter the lifter 408 begins rotating.

[0060]

When the second transfer mechanism 29 withdraws to the outside of the washing/transfer unit 27, the lift plate 409 is further lifted up to keep the wafer W at a level at which the space opened like U shape of the edge remover 421 is present. In this state, the edge remover 421 moves to a position close to the edge of the wafer W in a radial direction of the wafer W.

[0061]

When the edge remover 421 becomes close to the position to sandwich the edge of the wafer W as shown in FIG. 10, the edge remover 421 stops and the above-described washing of the edge of the wafer W is carried out.

[0062]

After the washing of the edge of the wafer W is completed, the rotation of the lifter 408 is once stopped, and the edge remover 421 moves outwardly in the radial direction of the wafer W to be apart from the wafer W. At this time, vacuum-chucking toward the lift plate 409 is released.

[0063]

Subsequently, the lifter 408 falls to its lowermost position. At the time the lifter 408 falls, the wafer W mounted on the lifter 408 is hung and held by the holding member 404 of the rotation table 406. However, since at this time the rotation table 406 is not rotated, the holding portion 54 of the holding member 404 is maintained generally vertically and thus does not work to press the wafer edge, as described above. Therefore, the wafer W held by the holding member 404 is merely mounted thereon, and thus can easily be lifted up by the

lifter 408 if its vertically upward force is exerted.

[0064]

Next, the upper surface of the wafer W is washed by pure water by supplying pure water from the main washing nozzle provided above the wafer W, while the rotation table 406 is rotated together with the wafer W. At this time, because the holding member 404 holds the wafer W by applying an inward pressing force in the radial direction due to the rotation of the rotation table 406, the wafer W is fixed to the rotation table 406 firmly.

[0065]

After washing of the upper surface of the wafer W by pure water is completed, washing liquid is supplied to the pipe 410 passing through the interior of the lifter 408. The washing liquid is supplied to the side of the lower surface of the wafer W through the plurality of holes opened in the lift plate 409, and the lower surface of the wafer W is chemically washed by this washing liquid.

[0066]

After the chemical washing of the lower surface of the wafer W is completed, while the same state is maintained, N<sub>2</sub> gas is purged from the main washing nozzle provided above and from the lift plate 406 provided below and spin-drying is performed by rotating the rotation table 406 at high speed.

[0067]

After spin-drying is completed, the rotation of the rotation table 406 is stopped, and the lifter 408 moves up and raises the washing-completed wafer W, so that the wafer W is transferred by the second transfer mechanism 29 to the outside of the drying unit 27.

[0068]

In the above-described embodiment, the edge remover 421 is structured such that the first and second nozzles are buried in only the side of the plated surface of the wafer W to make the chemical be discharged from only above

the plated surface. However, as shown in FIG. 10, it may be structured such that similar nozzles are buried in the side of the lower surface to allow the chemical to be supplied also from below the wafer W.

[0069]

According to this structure, it is possible to remove a Cu plated layer which advances to the lower surface of the wafer W by plating, and to prevent the chemical discharged from the nozzles provided above from circulating to the back surface.

[0070]

Further, the edge remover is structured such that two nozzles are buried therein to discharge chemicals independently from the respective nozzles and mix the chemicals on the wafer W. However, it may be structured such that a mixture liquid of the chemicals is discharged from one nozzle. In this case, a mixture liquid of hydrofluoric acid :  $H_2O_2 : H_2O = 1 : 1 : 23$ , etc. is used.

[0071]

In the washing apparatus of the present embodiment, the edge removers 421 are arranged at two locations. However, the edge removers 421 may be provided at three or more locations, whereby the edge of the wafer W may be washed.

[0072]

In the above-described embodiment, there has been explained a structure for placing a processing target by facing its process-applied surface upward and for liquid-processing the edge of this surface. However, the process-applied surface may be faced downward and the edge of this surface may be processed in this state.

[0073]

Further, instead of rotating the processing target and liquid-processing the edge of the processing target by the fixed edge removers 421 as in the above-described embodiment, the edge removers 421 may be rotated while

the processing target is fixed, to liquid-process the edge of the processing target.

[0074]

In the above-described embodiment of the present invention, there has been explained a case where a semiconductor wafer is subjected to liquid processing. However, the liquid processing apparatus of the present invention can be applied to processing of a glass substrate or the like for an LCD, in addition to a semiconductor wafer as a processing target.

[0075]

[Effects of the Invention]

As explained above, according to the present invention, there is provided a liquid processing apparatus which can wash the edge of a substrate without giving an adverse influence on a device. Further, according to the present invention, there is provided an apparatus for washing the edge of a plated semiconductor wafer, making it possible to restrict generation of particles peeled from the wafer edge and to prevent a carrier and the like from being polluted.

[Brief Description of the Drawings]

[FIG. 1]

FIG. 1 is a schematic three-dimensional cubic diagram showing the entire structure of a plating apparatus according to an embodiment of the present invention.

[FIG. 2]

FIG. 2 is a schematic plan view showing the entire structure of the plating apparatus according to the embodiment.

[FIG. 3]

FIG. 3 is a schematic side view showing the entire structure of the plating apparatus according to the embodiment.

[FIG. 4]

FIG. 4 is a cross section of a washing/drying apparatus according to the embodiment of the present invention.

[FIGS. 5]

FIGS. 5 are a side view and a front view of a holding member 404 for a wafer according to the embodiment.

[FIG. 6]

FIG. 6 is a diagram showing the placement of edge removers 421 according to the embodiment of the present invention.

[FIG. 7]

FIG. 7 is a diagram showing a method of washing the edger of a wafer by the edge remover 421 according to the embodiment.

[FIG. 8]

FIG. 8 is a diagram showing a method of washing the edger of a wafer by the edge remover 421 according to the embodiment.

[FIG. 9]

FIG. 9 is a cross section of a washing/drying apparatus according to the embodiment.

[FIG. 10]

FIG. 10 is a diagram showing a method of washing the edge of a wafer by the edge remover 421 according to the embodiment.

[Explanation of Reference Numerals]

- 11 plating apparatus
- 21 cassette station
- 22 processing station
- 23 wafer cassette
- 25 first transfer mechanism
- 26 plating unit
- 27 washing/drying unit
- 28 extra unit

29 second transfer mechanism

402 housing

404 holding member

406 rotation table

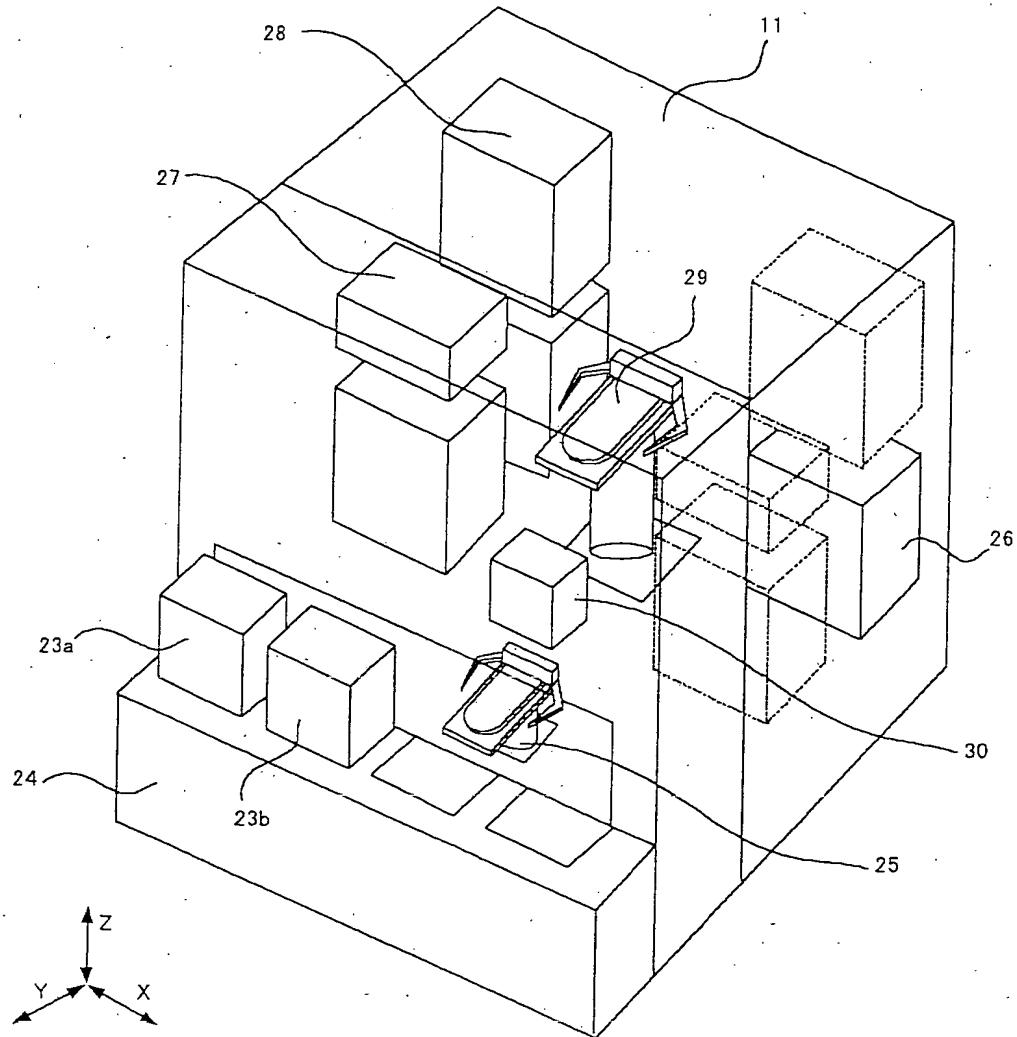
408 lifter

409 lift plate

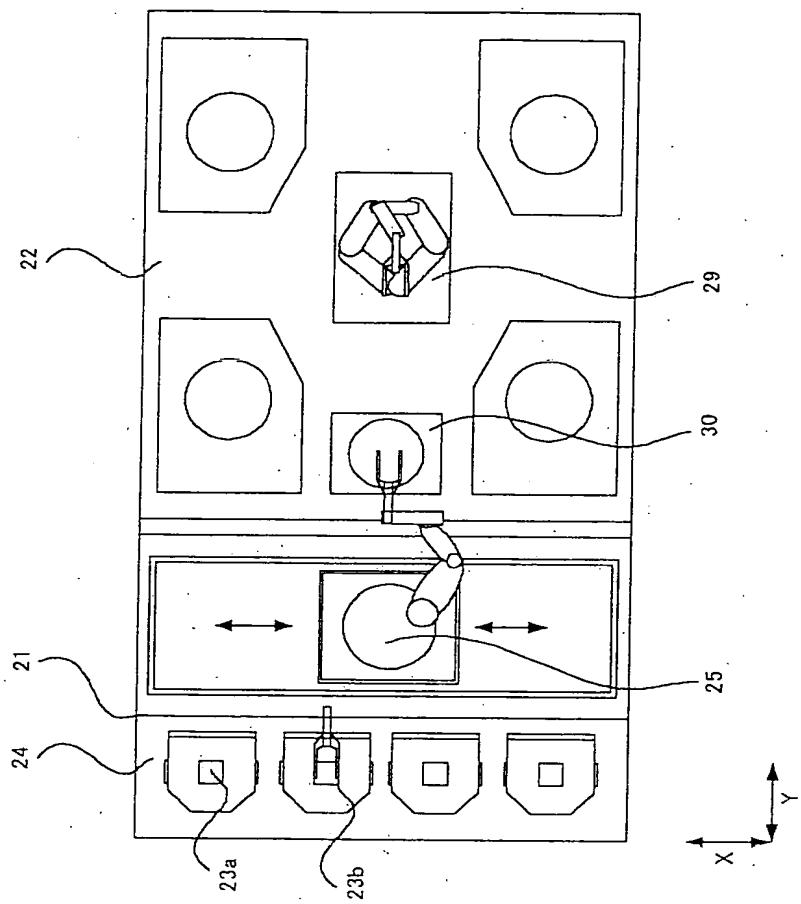
421 edge remover

W wafer

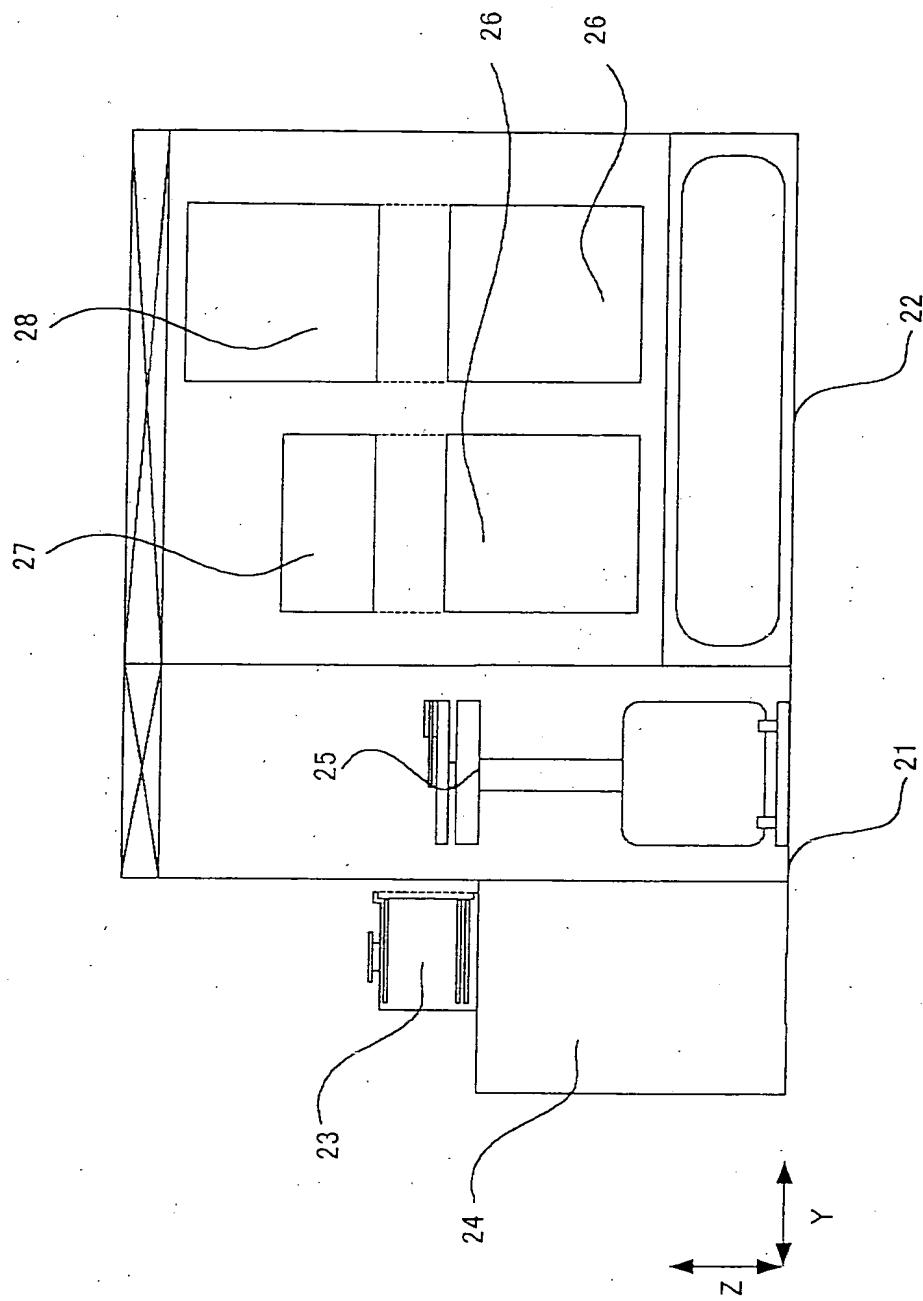
【書類名】 図面  
[NAME OF DOCUMENT] DRAWING  
【図1】 [FIG. 1]



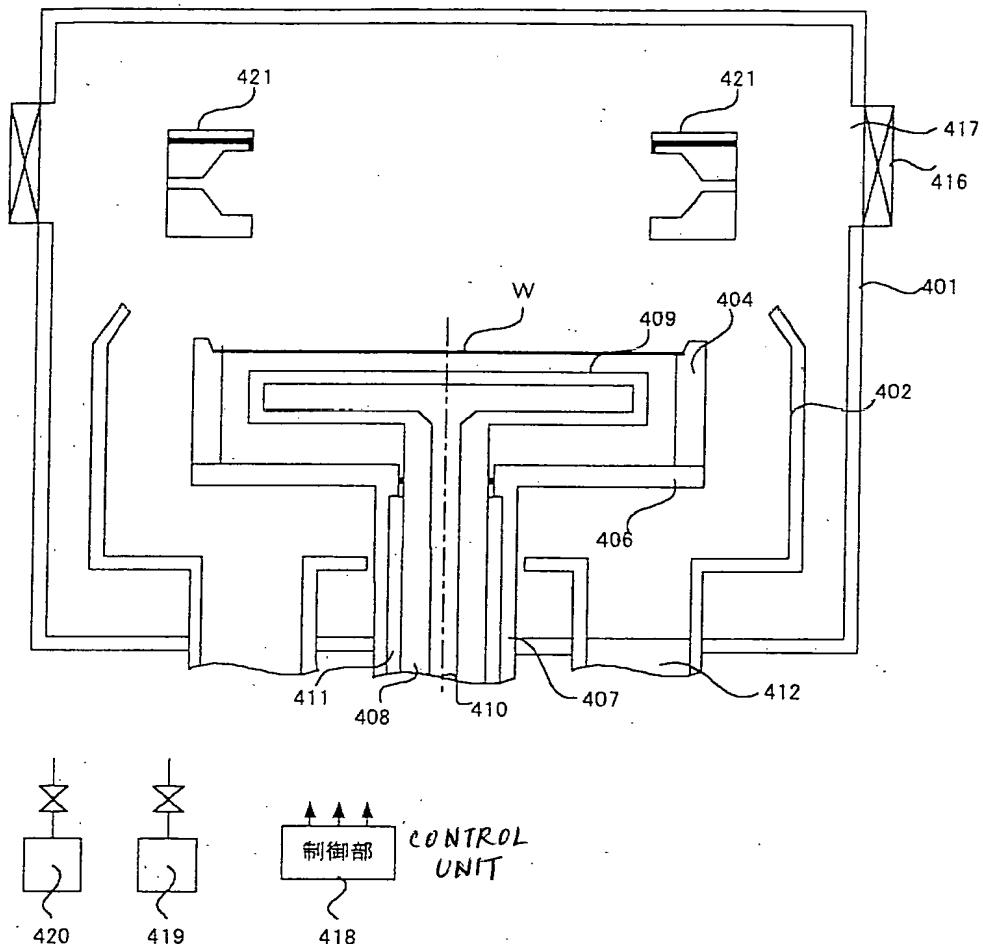
【図 2】 [FIG. 2]



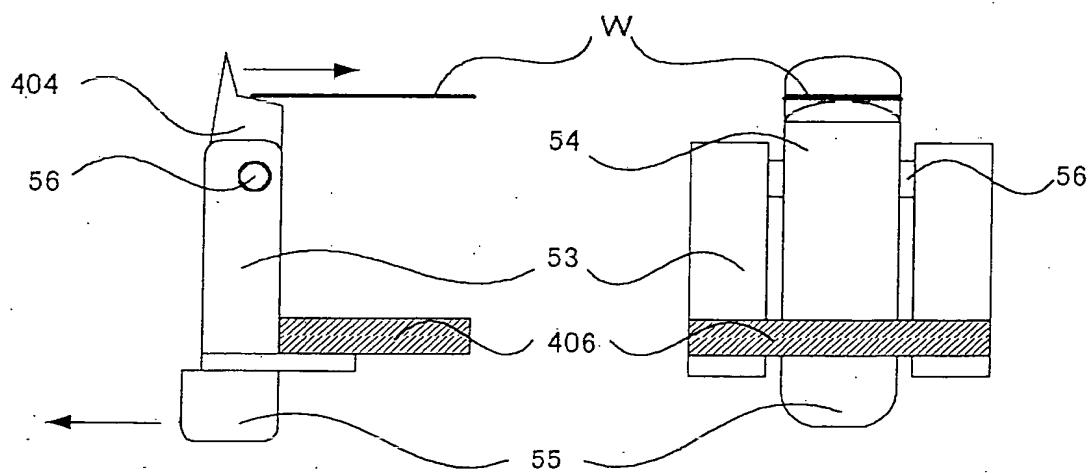
【図 3】 [FIG. 3]



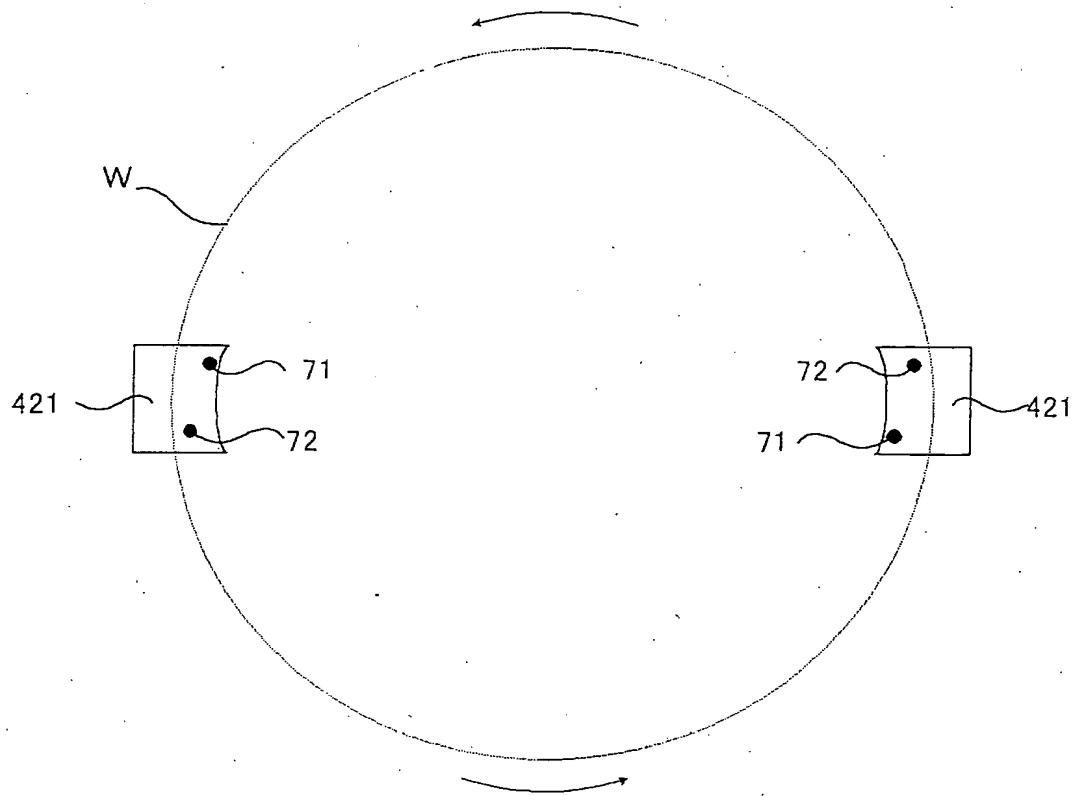
【図 4】 [FIG. 4]



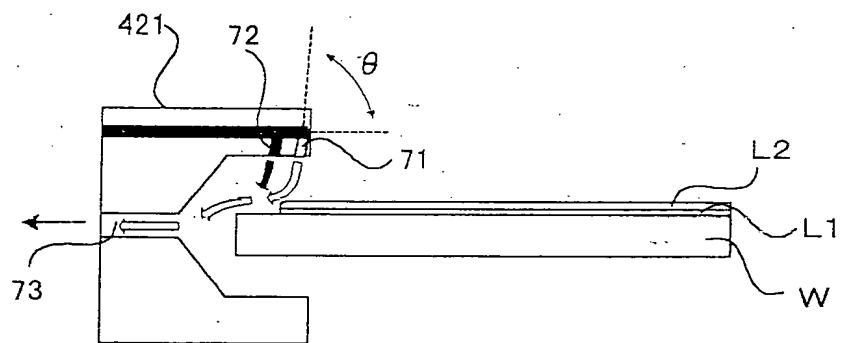
【図 5】 [FIG. 5]



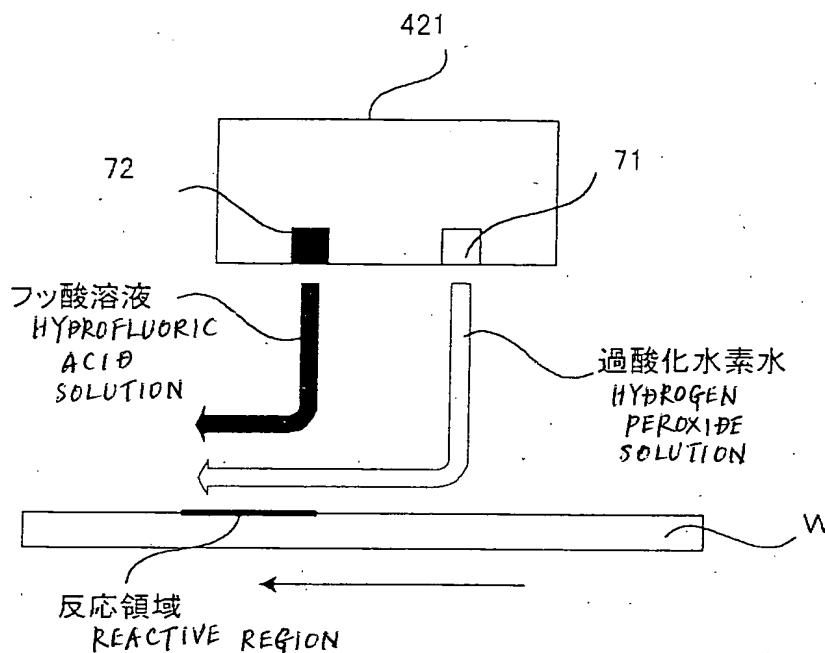
【図 6】 [FIG. 6]



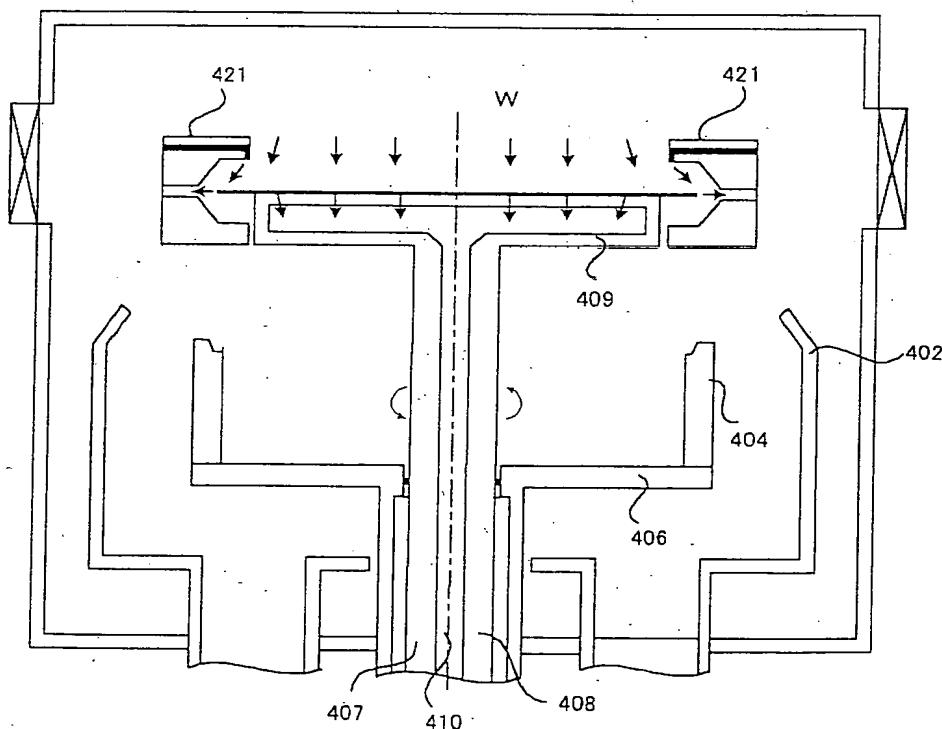
【図 7】 [FIG. 7]



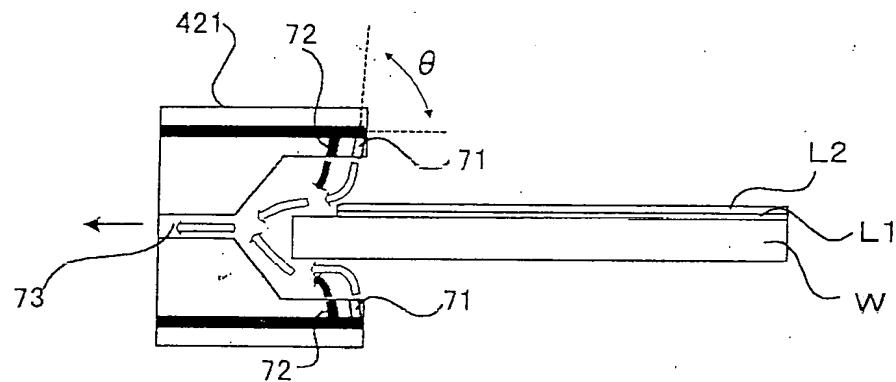
【図8】 [FIG.8]



【図9】 [FIG. 9]



【図10】[FIG. 10]



[Name of Document] Abstract

[Abstract]

[Object] To process an unnecessary thin film at the edge of a substrate in a way that processing liquids do not scatter onto a device manufacture area of the substrate.

[Solution] While a substrate is rotated, a thin film at the edge of the substrate is removed by discharging a first processing liquid from a first nozzle to the edge of one surface of the substrate, then discharging a second processing liquid from a second nozzle to the edge of the substrate to which the first processing liquid has been supplied from the first nozzle, and mixing the liquids. The processing liquids are sucked from a sucking hole provided closely to the edge of the substrate.

[Selected Drawing] FIG. 7

## CERTIFIED/ADDITIONAL INFORMATION

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